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PROJECTILE RETRIEVAL SYSTEM

TO THE COMMISSIONER OF PATENTS AND TRADEMARKS:

Your petitioners, Jimmy A. Parks and Kyle Bateman, citizens of the United States and residents of Utah, having post office addresses at 690 West 2400 North, Lehi, Utah 84043 and P.O. Box 636, Provo, Utah 84603, pray that letters patent may be granted to them as inventors of the improvement in a Projectile Retrieval System as set forth in the following specification.

Randall B. Bateman, P.C.
10 W. 100 South, Suite, 425
P.O. Box 1319
Salt Lake City, UT 84110
(801) 539-1900

BACKGROUND OF THE INVENTION

1. Related Applications

[0001] The Present Application claims the benefit of U.S. Provisional Patent Application Serial No. 60/411,190, filed September 17, 2003.

2. Field of the Invention

[0002] The present invention relates to a system for retrieval of projectiles fired into a bullet stop and containment chamber. More particularly, the present invention relates to a system which removes bullets and bullet fragments from a series of containment chambers or an elongate chamber more conveniently and with less environmental exposure to the lead of the bullets.

3. State of the Art

[0003] In order to maintain their proficiency with various types of firearms, law enforcement officers and others routinely engage in target practice. For many years, target practice was conducted in environments in which there was little concern for recovering the bullets. Firing ranges commonly used a large mound of earth to decelerate the bullet after it had passed through the target. Such a system was generally safe, in that the dirt was effective in

Randall B. Bateman, P.C.
10 W. 100 South, Suite, 425
P.O. Box 1319
Salt Lake City, UT 84110
(801) 539-1900

stopping the bullet and preventing injuries. (While the most common projectile at a firing range is a bullet, other projectiles, such as shot, can also be present. Thus, as used herein, projectiles includes bullets and vice versa.)

[0004] More recently, considerable concern has been raised about the lead contained in the bullet. Though the bullet fired in to the mound of dirt was safely contained from the point of being a moving projectile with a significant amount of inertial momentum, the lead in the bullet was free to escape into the environment. For example, when a mound containing a number of bullets became wet, lead could leach into surrounding soil and even the groundwater. When a range was used frequently, a considerable amount of lead could be released into the environment, thereby potentially injuring wildlife and contaminating groundwater supplies.

[0005] Partially due to these concerns, firing ranges increasingly turned to the use of bullet containment chambers to capture fired bullets and fragments thereof. The bullets may be recycled or otherwise disposed of in accordance with environmental regulations. Bullet containment chambers typically include an opening through which the bullet enters, a deceleration mechanism for slowing the bullet to a stop, and a container mechanism for holding the bullet until it is retrieved from the containment chamber.

Randall B. Bateman, P.C.
10 W. 100 South, Suite, 425
P.O. Box 1319
Salt Lake City, UT 84110
(801) 539-1900

[0006] One early bullet containment chamber is shown in U.S. Patent No. 684,581 to Reichlin. The chamber had an opening over which a target was placed. The chamber sloped downwardly and inwardly to provide a rounded deceleration path. A container area was also provided at the bottom of the unit to collect bullets.

[0007] An alternate design is shown in U.S. Patent No. 2,013,133 to Caswell. Rather than directing the bullet in a vertically circular path, the bullet stop of Caswell had the bullet travel initially in a generally horizontal circle as it decelerated. As the bullet slowed, it would drop to the bottom of the deceleration chamber where it could be retrieved.

[0008] Still another configuration of a bullet containment system is shown in U.S. Patent No. 4,28,109 to Simonetti. The system uses a granular impact material to decelerate the projectile. The impact material is cycled to provide ongoing inflow of impact material, and the bullets can be removed and recycled, etc.

[0009] Yet another configuration for containing bullets is shown in U.S. Patent No. 5,255,924 to Copius. Similar to the traditional mound method, the patent teaches the use of a mound of sand to decelerate the projectiles. A drainage system is disposed under the sand to collect and process water which has come into contact with lead bullets and fragments contained within the same.

Randall B. Bateman, P.C.
10 W. 100 South, Suite, 425
P.O. Box 1319
Salt Lake City, UT 84110
(801) 539-1900

[0010] Still yet another bullet containment system is contained in U.S. Patent No. 5,811,718 to Bateman. The containment system utilizes angled impact plates to decelerate bullets. Once the bullets had slowed sufficiently, they would fall into a canister mounted below the containment chamber.

[0011] Recognizing the environmental concerns raised by the lead dust which is created as the bullet is slowed to a stop, Bateman utilized a negative air system to draw air containing lead dust out of the containment chamber. The air could then be filtered to remove the lead dust prior to release into the atmosphere. The Bateman configuration is highly advantageous over most of the prior art configurations because lead dust is significantly reduced without the use of water or other carrying mediums. Those skilled in the art will appreciate that once water becomes contaminated with lead dust, disposal of the water can cause significant challenges - both environmentally and financially.

[0012] One drawback which most of the prior configurations have had is that someone must retrieve the bullets from the containment chamber. This can be particularly time consuming on a large range which may have over two hundred canisters for collecting bullets. Even if the person removing the bullets works quickly, it could take a couple of hours or more to empty each bullet containing canister. Additionally, even a small canister filled with lead can be relatively heavy.

Randall B. Bateman, P.C.
10 W. 100 South, Suite, 425
P.O. Box 1319
Salt Lake City, UT 84110
(801) 539-1900

[0013] Of even greater concern, however, is the careful handling which must be used by those collecting the bullets. In order to remove the bullets, the person retrieving the bullets must first put on a hazardous materials suit to protect the person from the lead dust associated with the bullets. The suit may be cumbersome and uncomfortable and may be extremely hot. Additionally, if collection is occurring while the range is in use, the range must be configured so that the person retrieving the bullets cannot be hit by ricochets, etc. Also, each impact of the bullet generates lead dust which can be released into the atmosphere. Thus, with many configurations it is unwise to attempt to retrieve bullets while the particular containment chamber is being used.

[0014] One presently available system which resolves many of these concerns is disclosed in U.S. Patent No. 6,311,980 to Sovine et al. The patent discloses a pneumatic bullet retrieval system which is constructed to minimize the release of lead dust while transporting the bullets to a central location.

[0015] While use of a pneumatic system is highly desirable, there are times when the volume of projectiles or other concerns makes using a purely pneumatic system difficult.

[0016] Others have used conveyers to transport bullets from individual bullet deceleration areas to a common collection point. Such systems, however, are disadvantageous for several reasons.

Randall B. Bateman, P.C.
10 W. 100 South, Suite, 425
P.O. Box 1319
Salt Lake City, UT 84110
(801) 539-1900

First, as the conveyer belt rotates, and dumps the collected bullets, some bullet fragments will cling to the belt for a short distance. If the underside of the belt is not enclosed, the lead fragments and dust will fall to the ground and pollute the area behind the trap. If the belt is enclosed, the enclosure must be periodically opened to clean out the lead buildup. Due to the construction of most bullet traps, this requires the range to be shut down during cleaning.

[0017] Thus, there is a need for an improved method for mechanically moving bullets and fragments from bullet deceleration areas to a central collection location. Such a system should be easy to use and should minimize contact between the lead bullets and those charged with retrieval. Additionally, the system should save time and decrease costs associated with bullet retrieval.

SUMMARY OF THE INVENTION

[0018] It is an object of the present invention to provide a bullet retrieval system which has one or more advantages over the prior art.

[0019] The above and other objects of the invention are realized in specific illustrated embodiments of a bullet retrieval system including an elongate screw drive which is disposed in communication with one or more bullet deceleration areas to receive

Randall B. Bateman, P.C.
10 W. 100 South, Suite, 425
P.O. Box 1319
Salt Lake City, UT 84110
(801) 539-1900

and transport bullets to a remote location. As the invention includes several different embodiments, it will be appreciated that each will have its own advantages and disadvantages with respect to each other and the prior art. Thus, the description contained herein is merely exemplary and is not intended to limit the scope of the appended claims.

[0020] In accordance with one aspect of the invention, a plurality of control members which are placed in communication with a plurality of bullet containment chambers. The control members are further disposed in communication with each other via a bullet transport mechanism which carries the bullets from the control members to a central processing location.

[0021] In accordance with another aspect of the invention, the elongate screw conveyer which moves the bullet is enclosed so as to prevent lead fragments and lead dust from contaminating the area behind the bullet deceleration area.

[0022] In accordance with another aspect of the invention, a vacuum system is disposed in communication with the enclosure surrounding the elongate screw conveyer so as to draw lead dust out of the enclosure.

[0023] In accordance with another aspect of the invention, the vacuum is sufficiently strong to create a slight negative pressure within the bullet deceleration area, to draw lead dust through the

Randall B. Bateman, P.C.
10 W. 100 South, Suite, 425
P.O. Box 1319
Salt Lake City, UT 84110
(801) 539-1900

bullet deceleration area and into the screw conveyer. The lead dust is, in turn, drawn out of the screw conveyer and removed by a HEPA filter or the like. Additionally, the negative pressure can be used to ensure that lead dust does not escape through any openings in the housing.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The above and other objects, features and advantages of the invention will become apparent from a consideration of the following detailed description presented in connection with the accompanying drawings in which:

[0025] FIG. 1 shows a side cross-sectional view of a bullet stop and containment chamber in accordance with the teachings of the present invention;

[0026] FIG. 2 shows a schematic view of a bullet retrieval system made in accordance with another embodiment of the present invention; and

[0027] FIG. 3 shows a schematic view of yet another embodiment of a bullet retrieval system formed in accordance with the present invention; and

[0028] FIG. 4 shows a schematic view of still another embodiment of a bullet retrieval system formed in accordance with the present invention;

Randall B. Bateman, P.C.
10 W. 100 South, Suite, 425
P.O. Box 1319
Salt Lake City, UT 84110
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DETAILED DESCRIPTION

[0029] Reference will now be made to the drawings in which the various elements of the present invention will be given numeral designations and in which the invention will be discussed so as to enable one skilled in the art to make and use the invention. It is to be understood that the following description is only exemplary of the principles of the present invention, and should not be viewed as narrowing the pending claims. Furthermore, it should be appreciated that the components of the individual embodiments discussed may be selectively combined in accordance with the teachings of the present disclosure.

[0030] Referring to FIG. 1, there is shown a side cross-sectional view of a bullet stop and containment chamber, generally indicated at 10, in accordance with the principles of the prior art. The bullet stop and containment chamber 10, includes a channel 12 which is configured for directing projectiles into a deceleration area formed by a chamber 16. The channel 12 is formed by an upper plate 20 and a lower plate 22 which are typically placed at complementary acute angles to the generally horizontal plane of travel of a projectile to direct the projectile into an opening 26 into the chamber 16. (Of course, other plate configurations could be used.)

[0031] After passing through the opening 26, the projectile

Randall B. Bateman, P.C.
10 W. 100 South, Suite, 425
P.O. Box 1319
Salt Lake City, UT 84110
(801) 539-1900

impacts a plurality of impact plates, such as impact plate 34, impact plate 34" and impact plate 36. The impact plates 34, 34" and 36 decelerate the projectile and lead to an egress 44 from the chamber 16. A check plate 46 is also provided to ensure that a projectile does not leave the bullet containment chamber with a significant amount of inertial momentum.

[0032] Disposed below the bullet containment chamber 16 is an outlet 82 which leads into a housing 86 which forms a transport tube for collecting projectiles which have been fired into the bullet stop and containment chamber 10. Preferably, the housing 86 is configured so that it is substantially air tight, other then the opening at the outlet 82 and an outlet to the housing. In such a manner, the spilling of lead dust behind the bullet stop and containment chamber 10 is virtually eliminated.

[0033] Disposed in the housing 86 is an elongate screw 90 which forms a worm drive or screw conveyer for moving bullets and bullet fragments to one end of the housing. The bullets and fragments can then be collected in a container (not shown in FIG. 1) and recycled.

[0034] One significant advantage of the configuration shown in FIG. 1, is that it does not require an individual to empty a receptacle below the bullet stop. Not only does this reduce the risk of exposure to lead dust, it also allows the bullet stop and containment chamber to be used for target practice while the

Randall B. Bateman, P.C.
10 W. 100 South, Suite, 425
P.O. Box 1319
Salt Lake City, UT 84110
(801) 539-1900

bullets and bullet fragments are being removed. Thus, a bullet trap can be used at full capacity over a prolonged period of time, with the bullets being cleaned from the trap as needed without any decrease in use.

[0035] The elongate screw 90 which forms the worm drive or screw conveyer is preferably suspended by a mating flange and support 94 which wraps about the axis 98 of the elongate screw. The helical flange 92 which wraps about the screw's axis continually moves the lead downstream as long as the screw is rotating.

[0036] While the housing 86 can be open, it is preferred that the housing be enclosed so that the only entry into the housing is through the openings 82, and the only exit is at the end of the housing. In this manner, any lead dust in the housing will not leak out and contaminate the area behind the bullet stop and containment chamber 10.

[0037] To keep the housing 86 substantially air tight (other than the openings 82, the housing includes a flange 102 which is attachable to a complementary flange 106 attached to the openings 82. Preferably, this attachment is made by screws or other removable fasteners, so that the interior of the housing 86 can be accessed if needed.

[0038] As the projectile decelerates, it falls through the opening into the housing 86. Periodically, the elongate screw 90 is turned,

Randall B. Bateman, P.C.
10 W. 100 South, Suite, 425
P.O. Box 1319
Salt Lake City, UT 84110
(801) 539-1900

thereby causing any bullets and bullet fragments to be pushed to one end of the housing, where they can be disposed of properly. The frequency at which the screw is turned will depend on the volume of fire the bullet stop and containment chamber 10 is taking, and the number of such chambers which are disposed in communication with the housing.

[0039] Thus, for example, if thirty bullet stop and containment chambers were disposed in communication with the housing and all were being used for a training seminar, the screw conveyor may operate substantially continuously for a period of time. If, in contrast, only a few bullet stop and containment chambers were being used, the screw conveyer may only be actuated every ten or fifteen minutes.

[0040] While belt conveyers have been tried for moving bullets from bullet traps, they raise a host of problems. Bullet fragments can stick to the belt and either fall to the ground or fall into a containment structure causing build-up. The elongate screw 90, in contrast, keeps the bullets and bullet fragments moving toward the end of the housing 86. While a small amount of lead may collect on the walls of the housing, the screw continually moves along the walls and prevents any build-up from becoming too large. Thus, it is preferred that the screw be formed of steel or some other hard material which will scrape any lead build-up off the housing 86. Because lead dust will have little ability to build up, it is

Randall B. Bateman, P.C.
10 W. 100 South, Suite, 425
P.O. Box 1319
Salt Lake City, UT 84110
(801) 539-1900

believed that the screw conveyer will be substantially more reliable than the belt conveyers that have been used in the past.

[0041] Those skilled in the art will appreciate that the screw drive may be formed from an integral unit, or may be formed in segments, which have some sort of coupling between them. Likewise, the housing 86 can be substantially one piece, or can be formed in segments.

[0042] While the screw drive 90 is shown in FIG. 1 has being in the housing, those skilled in the art will also appreciate that the screw drive can be disposed inside the bullet stop and containment chamber. Typically, in such a configuration, the screw drive would be disposed behind some sort of a deflecting plate or otherwise positioned to minimize the amount of wear caused by bullet impacts.

[0043] Turning now to FIG. 2, there is shown an alternate embodiment of the invention. A plurality of bullet stop and containment chambers 110 are disposed in an array. Each bullet stop and containment chamber has an outlet 112 which leads into a control member 116. The control member 116, in turn, leads into a transport housing 120, which utilizes a screw conveyer 124 driven by a motor 130 to move bullets and bullet fragments to a remote container 128. Additionally, a manual crank arm 131 can also be used for rotating the elongate screw. The manual crank arm 131 can be used to clean the trap in the event the motor 130 fails. In smaller bullet stops, the manual crank arm 131 could be used as the

Randall B. Bateman, P.C.
10 W. 100 South, Suite, 425
P.O. Box 1319
Salt Lake City, UT 84110
(801) 539-1900

sole source of power for the screw conveyer 124.

[0044] The control members 116 are preferably in communication with a remote control 132 which allows a range operator to open one or more of the control members 116 at a time. By allowing the selective opening of the control members 116, a range operator is able to select when bullets are passed into the transport housing 120. This prevents a large number of bullets and/or bullet fragments from gathering at one end of the housing. Those skilled in the art will appreciate that if a very long transport housing was used to transport bullets from a large number of bullet stop and containment chambers, a large number of bullets could be present near the end of the screw drive. By controlling release of the bullets, any potential for overload could be averted. Additionally, the remote control 132 can be used to control the motor 130, to thereby control movement of the screw conveyer 124.

[0045] Turning now to FIG. 3, there is shown an alternate embodiment of a bullet retrieval system, generally indicated at 140, made in accordance with the principles of the present invention. The bullet retrieval system 140 includes substantially all of the components of the system in FIG. 2 and is numbered accordingly. It should be appreciated, however, that while this is one preferred embodiment, various components may be omitted without departing from the scope and spirit of the invention.

[0046] The bullet retrieval system of FIG. 3 is different from

Randall B. Bateman, P.C.
10 W. 100 South, Suite, 425
P.O. Box 1319
Salt Lake City, UT 84110
(801) 539-1900

that of FIG. 2 in that it also includes a vacuum system, generally indicated at 150. The vacuum system 150 preferably includes a tube 154 which is disposed in communication with the housing 124, and a vacuum 158 for creating negative air pressure in the tube. The vacuum also includes a filter 162, preferably a HEPA filter. When the vacuum 158 is on, a negative air pressure is developed in the tube 154 and in the housing 124 to which it is connected. This negative air pressure draws air from the openings 112 in the bullet stop and containment chambers 110, through the housing 124 and into the vacuum system where the air can be cleaned via the HEPA filter 162 prior to discharge. The airflow also will carry lead dust from out of the bullet stop and containment chambers 110 and the housing 124, thereby minimizing the risk that the lead dust will flow out of the trap and come into contact with users or range personnel.

[0047] The amount of negative air pressure which will be developed in each of the bullet stop and containment chambers 110 depends both on the amount of suction produced, and the number and size of openings into bullet containment chambers. Thus, greater suction can be generated in each of the bullet stop and containment chambers by selectively opening and closing the control members 116.

[0048] Now turning to FIG. 4, there is shown a retrieval system which is similar in many respects to that shown in FIG. 2. Instead

Randall B. Bateman, P.C.
10 W. 100 South, Suite, 425
P.O. Box 1319
Salt Lake City, UT 84110
(801) 539-1900

of the screw 124 being formed with a helical flange(s) extending in one direction, a pair of flanges 126a and 126b are disposed in opposite directions on opposing ends of the screw 124. When the screw is rotated, the flanges channel the bullets to a central collection location 128 along the housing. Likewise, the flanges could be disposed in the opposite configuration to channel the bullets into two collection containers at opposing ends of the bullet trap.

[0049] The present invention is advantageous in that it substantially reduces the risk of exposure of large amounts of lead dust, while not requiring sufficient suction to move bullets and bullet fragments. Additionally, the number of times that range personnel are likely to be exposed to lead dust is substantially reduced.

[0050] Thus there is disclosed an improved bullet retrieval system which decreases environmental exposure to lead, increases the efficiency of bullet recovery, and which does not interfere with use of the range during bullet retrieval. Those skilled in the art will appreciate numerous modifications which can be made without departing from the scope and spirit of the present invention. The appended claims are intended to cover such modifications.

Randall B. Bateman, P.C.
10 W. 100 South, Suite, 425
P.O. Box 1319
Salt Lake City, UT 84110
(801) 539-1900